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SELF-CONTROL AND THE PREFERENCE FOR DELAYED REINFORCEMENT: AN EXAMPLE IN BRAIN INJURY

MARK R. DIXON AND MOLLIE J. HORNER

SOUTHERN ILLINOIS UNIVERSITY

AND

JOHN GUERCIO

CENTER FOR COMPREHENSIVE SERVICES

We investigated the effects of a concurrent physical therapy activity (keeping the hand open) during delays to reinforcement in an adult man with acquired brain injuries. Once a relatively stable level of hand-open behavior was obtained, the participant was asked to choose between a small immediate reinforcer and a larger delayed reinforcer contingent on keeping the hand open at greater-than-baseline duration. Afterwards, the participant was asked to select between a larger delayed reinforcer with no hand-open requirement and the identical larger delayed reinforcer with a progressively increasing hand-open requirement. Results suggest a shift in preference to larger delayed reinforcers and an eventual preference for the hand-open requirement option.

DESCRIPTORS: self-control, impulsivity, physical therapy, delayed reinforcement

Self-control occurs when a participant selects a larger delayed reinforcer over a concurrently available smaller immediate reinforcer. Persons with acquired brain injury are sometimes resistant to physical therapy, perhaps choosing the immediate reinforcement of escape from the aversiveness of the therapy over the delayed reinforcement of eventually returning to a higher level of functioning.

One step is to increase the choice to engage in the therapy. Strategies that can be used to promote more optimal choice making include the fading of delay duration (Dixon & Cummings, 2001) or the introduction of a concurrent activity to be emitted during the delay (Dixon, Rehfeldt, & Randich, 2003). Another way to alter preference has been via the implementation of a signal or discriminative stimulus associated with one delayed alternative (Vollmer, Borrero, Lalli, & Daniel, 1999). Such stimuli may enhance preference for this option over a more immediate (and less optimal) alternative by serving a conditioned reinforcing function (Stromer, McComas, & Rehfeldt, 2000). Although Vollmer et al. demonstrated that a signaling stimulus such as a card or object can alter choice preference, it is unknown whether an actual low-probability behavior emitted by the participant could function similarly. Therefore, the purpose of the present study was to shift reinforcer preferences to those of more delayed options and assess the relative value of a concurrent physical therapy activity during the delays to reinforcement in a participant with acquired brain injuries.

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Address all correspondence to Mark R. Dixon, Behavior Analysis and Therapy Program, Rehabilitation Institute, Southern Illinois University, Carbondale, Illinois 62901 (e-mail: mdixon@siu.edu).

METHOD

Participant, Setting, and Materials

Eric was a 21-year-old man who had sustained brain injury as the result of a motorcycle accident. He had a history of refusing to attend and participate in physical therapy sessions. Eric typically walked with his left arm wrapped around his torso and kept his hand in the shape of a fist. Therefore the physical therapy activity recommended by his therapist consisted of having Eric open his hand. Hand-open behavior was operationally defined as his arm being no less than 3 in. from his torso with none of his fingers making contact with the palm of his hand. If Eric's fingers touched his palm, this ended the duration of hand-open behavior. All sessions were conducted in his bedroom (1.5 m by 3 m) that included a bed, dresser, and nightstand. The materials included two index cards representing choice consequences. A "Simpsons" cartoon was used as the reinforcer following a multiple stimulus preference assessment without replacement. Magnitudes of reinforcement were ratios of 2:1 for the larger and smaller reinforcer, respectively. This resulted in 30 s and 15 s of access to viewing the cartoon.

Experimental Design

A simultaneous treatment design was used in which preferences were assessed between alternatively available reinforcers. Reinforcers differed at times by size and delay and at other times by the presence or absence of an activity requirement. All sessions consisted of six to 12 trials, depending on condition.

Procedure

Natural baseline. Sessions began with the experimenter providing a single verbal prompt for Eric to engage in the target behavior (hand open) by saying, "Eric, please open your hand for me." Duration of hand opening was recorded following this prompt. Sessions were conducted until a relatively stable duration of the behavior was observed.

Choice baseline. During the choice baseline, Eric could chose between a small immediate reinforcer and a larger delayed reinforcer that also had a response requirement (holding his hand open for the duration of the delay). The delay for the larger reinforcer was set at 190 s or seven times the mean duration of hand-open behavior in the natural baseline. Eric made his choices by touching one of two index cards. Each card had a picture of the "Simpsons" cartoon on it; the size of the picture corresponded to the size of the reinforcer (i.e., the card associated with the small immediate reinforcer had the smaller picture on it). Eric was taught to discriminate between the two cards during two single-choice trials that preceded each block of 10 choice trials.

During single-choice trials, one index card was placed in front of Eric and, through physical or gestural guidance, he touched the card. If the card was associated with the small immediate reinforcer, the reinforcer was delivered immediately. If the card was associated with the large delayed reinforcer, it was removed, Eric was verbally prompted to open his hand, and the reinforcer was delivered following the required duration of hand opening. Each trial was followed by an intertrial interval (ITI) that was the amount of time between consumption of the reinforcer and the beginning of the next trial. When the larger delayed reinforcer was chosen, the ITI was 5 s. When the smaller immediate reinforcer was chosen, the ITI was calculated by adding 5 s to the hand-open time. ITIs were used to remove the possibility that choices were made to maximize reinforcement density.

During the two-choice trials, both cards were presented to Eric in random positions across trials. No prompts were provided to initiate selection. When he made physical contact with one of the cards, the corre-

sponding reinforcer (small immediate or large delayed) was delivered as described above. When both cards were touched at the same time or sequentially, the trial was repeated.

Activity preference training. During this condition two new cards were presented to Eric, initially as two single-choice trials and afterwards as 10 two-choice trials. The delay was identical for both cards (the same larger delayed reinforcer used during choice of 190 s). If Eric chose one card, reinforcement was delivered at the end of the delay independent of hand-open behavior. If Eric chose the other card, he was verbally prompted to open his hand during the delay, and reinforcement was delivered only if his hand remained open from that point to the end of the delay. Initially, the response requirement for reinforcement (i.e., how long his hand had to remain open) was set at 50% of the mean of the natural baseline or 14 s (i.e., he was prompted to open his hand after 176 s and it had to remain open for the last 14 s of the delay). The response requirement was progressively increased by 28 s following three consecutive selections in which Eric chose the card associated with the hand-open requirement.

Multiple probes of choice baseline. After every 12 trials of activity preference training, a probe of choice baseline conditions was administered. Eric was again asked to select between a small immediate and a larger delayed reinforcer as described above. This probe consisted of two single trials and four two-choice trials. The ITI procedures as described in choice baseline conditions were used during these probes.

Interobserver agreement. During 25% of sessions, a second observer was present for purposes of interobserver agreement measurement. Choice behavior was recorded by indicating a smaller versus larger reinforcer selection during choice baseline, or larger reinforcer with activity required versus larger reinforcer without activity required during activity preference training. An agreement was scored if both observers recorded the same option. Duration of engagement in hand-open behavior was recorded in seconds. An agreement was recorded if both observers recorded the same number of seconds ± 2 s. Interobserver reliability was calculated by dividing the number of agreements by the number of agreements plus disagreements between observers for both choice responses between alternatives and duration of hand-open behavior and multiplying by 100%. Resulting reliability was 100% for choice and 93% for duration.

RESULTS AND DISCUSSION

Figure 1 shows the number of seconds Eric engaged in hand-open behavior across natural baseline, choice baseline, and activity preference training conditions. During natural baseline, Eric held his hand open for 5 to 43 s. During choice baseline, Eric selected the small immediate option during 16 of the total 23 trials. With repeated trials of activity preference training (when both response options involved the larger delayed reinforcer but one option also had the response requirement), Eric often selected the option with the response requirement and hand opening increased. Toward the end of this phase, Eric opened his hand for the entire performance goal of 190 s. Interestingly, choice baseline probes showed that Eric increasingly chose the larger delayed reinforcer with the response requirement even when the alternative option involved the smaller delayed reinforcer, indicating a shift in his preference.

The present study adds to the literature on self-control by showing that manipulating response requirements in a choice arrangement can (a) increase a low-rate behavior and (b) shift preferences away from impulsive responding (i.e., choosing the

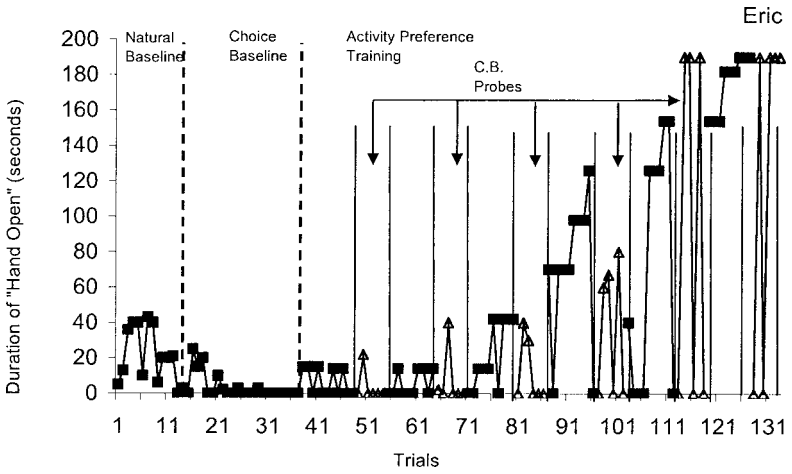

Figure 1. Eric's duration of hand-open behavior in seconds across natural baseline, choice baseline, activity preference training (filled squares), and choice baseline probes (open triangles).

smaller immediate reinforcer) and toward self-control (i.e., choosing the larger delayed reinforcer). One possible explanation of these results is that the required response functioned as a signal that bridged the gap between the choice response and the delayed reinforcer (see Stromer et al., 2000; Vollmer et al., 1999). An alternative explanation is that, because of the nature of brain injury, hand-open behavior may have increased as a function of natural recovery. Future studies should incorporate more participants in a multiple baseline design followed by the simultaneous treatment design of the present study to eliminate this possibility.

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